RESEARCH ON COLOMBIAN MEDICINAL PLANTS: ROLES AND RESOURCES FOR PLANT TAXONOMISTS

CHARLOTTE GYLLENHAAL, MARY LOU QUINN AND
DJAJA DOEL SOEJARTO *

Colombia has one of the richest floras of any country on earth. It has a large topographic range and varied climatic regimes, and is rich in endemic species (GENTRY, 1983). Many areas of the country have been poorly collected; nevertheless, SCHULTES (1951) estimates that 50.000 species of phanerogams grow in Colombia. PRANCE (1977) cites the lower figure of 45.000, and other workers have speculated that the diversity is even lower (GENTRY, 1978), Because the study of the flora of Colombia is not yet complete it is impossible to give an accurate figure for the number of plant species occurring in the country. It is certain, however, that Colombia is tremendously rich floristically, including in its flora perhaps as much as 50% of all the flowering plant species in the Neotropics (PRANCE, 1977).

The floristic resources of Colombia are a largely untapped reserve of species potentially useful to humankind. As our knowledge of Colombia's flora expands, science will continue to explore the use of these many thousands of species as sources of food, fiber, and chemicals, including medicines. This paper explores the medicinal potentials of Colombian plants, explains strategies for developing drugs from plants, discusses the roles taxonomists can play in the investigation of plant-derived drugs, and points out the usefulness of computerized information-processing in strategies of drug developments.

Plants have been important as medicines since the earliest stages of human culture, and they remain so today. Although some plant drugs have been replaced by synthetics, many cannot be synthesized economically and must still be obtained from natural sources. Therefore, plant extracts and

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* Program for Collaborative Research in the Pharmaceutical Sciences, College of Pharmacy, University of Illlinois at Chicago 833 South Wood Street Chicago, Illinois 60612, U.S.A.

naturally-derived chemicals still constitute a substantial share of the prescription drugs sold today. Even in the United States, where synthetic drugs predominate more than in most other countries, 25% of all prescriptions dispensed from community pharmacies between 1959 and 1973 contained active principles extracted from plants; this percentage remained steady during the entire 14-year period (FARNSWORTH and MORRIS, 1976). A partial analysis of prescription data for 1980 shows that the proportion of drugs derived from plants was still approximately 25%; the market value of plant-derived drugs in the United States was estimated to be over eight billion dollars (FARNSWORTH and LOUB, 1983). Only 41 species of seed plants contributed these medicines. Such plants as *Podophyllum peltatum* L. (source of podophyllin), *Pilocarpus jaborandi* Holmes (pilocarpine), *Duboisia myoporoides* R. Br. (atropine, hyoscyamine, scopolamine) and *Catharanthus roseus* (L.) G. Don (leurocristine and vincaleukoblastine) are some of the well known medicinal species included in this list. Most developing countries, and many European ones as well, rely much more heavily than the United States on the use of plant-derived drugs. Thus, although no estimates exist of the size of the world market for medicinal plants, it must be of an astonishing magnitude. Developing the potentially useful medicinal plant resources of Colombia could provide a welcome additional source of revenue for the economy of the country.

The development of medicines from plants is a complex scientific pursuit (FARNSWORTH and BINGEL, 1977). The field had languished for several years during the 1970's as the pharmaceutical industry, the academic community, and governmental agencies began to view research on plant-derived drug as inefficient, owing to the high cost of plant collections and the low percentage of commercially viable drugs obtained. During the 1980's, however, there has been a resurgence of interest in the development of medicinal plants (FARNSWORTH, 1983). Surveys of the methods used to develop plant drugs have been made, and they indicate that there are three basic strategies for the selection of promising candidate species: the random collection of plants followed by screening for biological activity, the investigation of plants related chemotaxonomically to known medicinal plants, and the selection of plants used in traditional medicine for screening and further laboratory investigation.

These strategies have been used by various investigators, and each method has its advantages and disadvantages. The random collection method, for intance, was used by the National Cancer Institute of the United States (SUFFNESS and DOUROS, 1982). Between 1961 and 1976 over 20.000 species of higher plants were screened for antitumor activity in laboratory animals. The plants to be screened were selected at random according to availability. Of the plants screened, 10% were active in the laboratory, but only a few reached the point of clinical trials in humans. Evaluation of the program showed that it had a low percentage of active substances and needed a large capacity for bioassays. Costs per active lead were thus high. However, many new compounds were discovered, and it was fairly easy to obtain plants.

Using chemotaxonomic relationship to predict activity is a strategy used frequently once significant activity has been discovered in a plant species. An example is the exploration of the genus *Stevia* (Compositae) during the investigation of stevioside, a naturally-occurring non-nutritive sweetener. Stevioside is found in *Stevia rebaudiana* (Bertoni) Bertoni (KINGHORN and SOEJARTO, 1985), the leaves of which have a sufficient amount of the compound to cause a noticeably sweet taste. In an effort to find chemical analogs and alternative sources for the compound, SOEJARTO *et al.*, (1982, 1983) instituted a sensory screening of the leaves of other plants in the genus. As a result of this effort, stevioside was found to occur in at least one other species, *S. phlebophylla* A. Gray. Sensory evaluation, however, represents an unusual application of this strategy; more typical is the phytochemical or biological screening of related species. Using the concept of chemotaxonomic relationship for drug development has the advantages of having a high ratio of active substances, and can contribute useful anologs of known compounds. It has the disadvantage that screening may result in the re-isolation of already known compounds.

The selection of plants used in traditional medicine for laboratory investigation played a role in the discovery of a "superstar" plant species, *Catharanthus* roseus (L.) G. Don (Apocynaceae) (FARNSWORTH, *et al.*, 1966). The Eli Lilly Company set up a program in which plants used in traditional medicine were screened for several pharmacological effects, including antitumor activity. Dr. GORDON H. SVOBODA selected 400 species for the general screening. The 40th species submitted was *Catharanthus roseus*, which is used as an anti-diabetic medication in Madagascar. It proved to be active in the antitumor screening test, and two highly successful anti-cancer drugs were isolated from it (SVOBODA and BLAKE, 1975). Vincaleukoblastine, the first drug, began to be marketed in 1961 for use in Hodgkin's disease and choriocarcinoma. Leurocristine, which was discovered shortly afterwards and reached the market in 1963, is one of the most widely used and effective antitumor agents, and is particularly important in the treatment of childhood leukemias. Two other antitumor agents, acronycine and 9-methoxyellipticine, were also found in the screening program, but they have not yet been commercialized.

The strategy of selecting plants used in traditional medicine has the advantages of having a higher ratio of active substances and lower screening costs than the massive random collection programs. Great care must be taken in the initial selection process, however, since traditional medicines often consist of complex mixtures of plants whose preparation may be kept secret and whose effectiveness may depend partly upon the psychological power of the rituals in which they are administered. In addition, botanical identification of the plants used may be difficult, and acquisition of sufficient quantities of material for assays may be expensive.

The three strategies for plant drug development share two requirements in the planning stage and throughout the implementation of the program. The first is for expert botanical assistance in the selection and collection phases of the study. Botanists are badly needed to provide identification of medicinal plants and supervise the preparation of adequate voucher specimens. Taxonomic expertise is often needed to sort out the taxonomic and nomenclatural problems pertaining to medicinally important species, since chemists and pharmacologists usually lack any but the most elementary botanical training. Expertise in this area can, for instance, prevent duplication of work already performed on a species under a different name.

Taxonomists can assist in correcting erroneous or missing authority citations for Latin binomials, and inaccurate family assignments, which are often found in the natural products literature (SOEJARTO, 1985). Finally, taxonomic botanists can make the local contacts necessary for the collection of plant samples for chemical and pharmacological studies, especially for large-scale collections, and their field experience may have acquainted them with practitioners of traditional medicine, making them a valuable resource in selecting the potentially useful species from traditional pharmacopeias.

The second requirement shared by the three strategies of plant drug development is the need for massive amounts of information during the selection phase. The methods of selection by chemotaxonomic relationship and use in traditional medicine will obviously require sophisticated information resources in the areas of chemistry, taxonomy, and ethnomedicine. Even the random collection method can be improved if duplication of studies already conducted by other investigators is avoided by checking in the literature. The literature on natural products, plant-derived medicines, and traditional healing, however, is voluminous, and many journals must be scanned in order to develop a broad understanding of the field. Unfortunately, the literature resources of many developing countries are limited; besides, it is a tedious and time-consuming job to cover the literature adequately. It thus becomes necessary to turn to computerized databases that cover the literature of natural products. There are at least ten databases that contain references pertinent to the development of plant-derived drug. They have been reviewed elsewhere (LOUB and FARNSWORTH, 1984). One database, NAPRALERT (Natural Products

ALERT) is tailored specifically to the demands of plant drug development, and includes folkloric as well as phytochemical, taxonomic and pharmacological data (FARNSWORTH *et al.*, 1981; FARNSWORTH and LOUB, 1983; FARNSWORTH, 1984).

NAPRALERT is based at the Program for Collaborative Research in the Pharmaceutical Sciences, College of Pharmacy, University of Illinois at Chicago. Approximately 150 million bytes of information make up the system. The database contains information from some 75.000 articles concerning 30.000 organisms which contain biologically active compounds or are used in traditional medicine. Phytochemical, ethnomedical, pharmacological, geographical, and taxonomic information on these organisms is recorded in the system. About 70% of the organisms are higher plants.

While most databases are bibliographic in nature, providing users with lists of references and abstracts of the cited articles, NAPRALERT is a "source" type database, which records specific textual and numeric information from each reference in retrievable form, and provides users with data in tabular format rather than abstracts. The database can be searched by organism name, by geographical area, by type of pharmacological activity or disease treated, and by chemical name as well as major class of chemicals or functional groups. The "source" features of NAPRALERT make it a useful research tool as well as an excellent bibliographic reference.

At present, the NAPRALERT database contains data on more than 300 Colombian plant species. A summary of this information is presented in table 1 (ethnomedical information), and Table 2 (biological and pharmacological information). Chemical data on at least 50 Colombian plant species are also listed in NAPRALERT. An examination of just a few of the references from which this material was drawn demonstrates the scope and coverage of the database and provides some interesting glimpses of the medicinal potentials of Colombian plant species. For example, GONZÁLEZ (1980) summarizes work being performed in Colombia on medicinal plants. Another example is a patent description of an alcoholic extract of *Jacaranda caucana* Pittier (Bignoniaceae) which possesses antitumor activity (FARNSWORTH *et al.*, 1978). *Maytenus laevis* Reiss. (Celastraceae), which is traditionally used for rheumatism and skin cancer in the Colombian Amazon, was reported by a group in Italy to contain phenoldienones which have been shown to possess antitumor activity in the laboratory (GONZÁLEZ *et al.*, 1982). A report from the Ohio State University describes alkaloids of *Thalictrum longistylum* DC. (Ranunculaceae), which have antimicrobial activity against *Mycobacterium smegmatis* (WU *et al.*, 1977). A report on *Amyris pinnata* HBK. (Rutaceae) describes the isolation of austrobailignan-1, an antitumor compound previously isolated only from a rare Australian species in the Austrobaileyaceae (BADAWI *et al.*, 1981). It must be noted that the data in Tables 1 and 2 also include species treated in the massive work of GARCÍA-BARRIGA (1974, 1975), which has been selectively computerized. Finally, the works of RICHARD SCHULTES (1963, 1975, 1979, 1983) on Colombian ethnobotany are well represented in the database. It should be emphasised that plant species in the tables are only those which were actually obtained from Colombia for the purpose of the studies used in constructing the tables. Numerous other Colombian species, both indigenous and introduced, whose ranges extend into neighboring countries, are also in NAPRALERT. However, studies on Colombian plants based on samples obtained from other countries are not included in these tables.

Because it has one of the world's richest floras, Colombia should become a focus for research in the development of new drugs from plants. There is an urgent need for such investigation in view of the rapid environmental changes currently taking place in the country, in particular through the utilization and destruction of the forests and the consequent disappearance of plant species-plants that may have great potential in medicine. It is next to impossible to place a monetary value on these species, but based on data already analyzed for the United States (FARNSWORTH & SOEJARTO, 1985), the value of such species may be billions of dollars. Plant taxonomists play a key role in the acquisition and identification of plant species for laboratory studies. Because of their interest in and intimate knowledge of the diversity of the floristic resources of Colombia, the local taxonomic community should be involved in the promotion of medico-botanical exploration, an activity of potential economic benefit to the nation as well as one of intellectual challenge and satisfaction.

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TABLE I

Plants of Colombia with ethnomedical information

Genus	*Species*	*Family*	*Use*
Abuta	Splendida	Menispermaceae	Arrow Poison
Acaena	Cylindrostachya	Rosaceae	Menstrual Inducer
Acanthospermum	Australe	Compositae	Antitumor
Acanthospermum	Hispidum	Compositae	Uterine Relaxant
Achillea	Millefolium	Compositae	Menstrual Inducer
Achyrocline	Lehmannii	Compositae	Antitumor
Achyrocline	Satureioides	Compositae	Antitumor
Adiantum	Capillus-veneris	Polypodiaceae	Menstrual Inducer
Adiantum	Cuneatum	Polypodiaceae	Menstrual Inducer
Ambelania	Cuneata	Apocynaceae	Fish Poison
Ambelania	Lopezii	Apocynaceae	Antifungal
Ambelania	Lopezii	Apocynaceae	Fish Poison
Ambelania	Lopezii	Apocynaceae	Arrow Poison
Ambelania	Markgrafiana	Apocynaceae	Antipyretic
Ambrosia	Cumanensis	Compositae	Menstrual Inducer
Ambrosia	Peruviana	Compositae	Menstrual Inducer
Ambrosia	Peruviana	Compositae	Uterine Relaxant
Anacardium	Occidentale	Anacardiaceae	Aphrodisiac
Ananas	Species	Bromeliaceae	Abortifacient
Andriapetalum	Polystachium	Proteaceae	Insecticide
Angelonia	Salicariaefolia	Scrophulariaceae	Contraceptive/Interceptive
Annona	Cherimolia	Annonaceae	Antitumor
Anthurium	Infectorium	Araceae	Source of Dye
Anthurium	Tessmannii	Araceae	Contraceptive/Interceptive
Apium	Graveolens	Umbelliferae	Menstrual Inducer
Apium	Graveolens	Umbelliferae	Uterine Relaxant
Aristolochia	Species	Aristolochiaceae	Aphrodisiac
Aristolochia	Species	Aristolochiaceae	Menstrual Inducer
Artemisia	Sodiroi	Compositae	Menstrual Inducer
Asclepias	Curassavica	Asclepiadaceae	Analgesic
Asclepias	Curassavica	Asclepiadaceae	Tooth Extraction
Aspidosperma	Curranii	Apocynaceae	Antasthmatic
Aspidosperma	Curranii	Apocynaceae	Antimicrobial
Aspidosperma	Curranii	Apocynaceae	Antivenin
Aspidosperma	Cuspa	Apocynaceae	Antivenin
Aspidosperma	Cuspa	Apocynaceae	Antiinflammatory
Aspidosperma	Megalocarpon	Apocynaceae	Skin Depigmentation

Genus	*Species*	*Family*	*Use*
Aspidosperma	Polyneuron	Apocynaceae	Antiasthmatic
Aspidosperma	Polyneuron	Apocynaceae	Antibacterial
Aspidosperma	Polyneuron	Apocynaceae	Antitumor
Aspidosperma	Polyneuron	Apocynaceae	Antispasmodic
Aspidosperma	Polyneuron	Apocynaceae	Antiinflammatory
Atropa	Belladonna	Solanaceae	Uterine Relaxant
Avicennia	Nitida	Verbenaceae	Antitumor
Baccharis	Genistelloides	Compositae	Hemostatic
Baccharis	Genistelloides	Compositae	Menstrual Inducer
Bixa	Orellana	Bixaceae	Aphrodisiac
Bixa	Purpurea	Bixaceae	Aphrodisiac
Bixa	Urucurana	Bixaceae	Aphrodisiac
Bonafousia	Tetrastachya	Apocynaceae	Irritant
Borojoa	Patinoi	Rubiaceae	Aphrodisiac
Brassica	Nigra	Cruciferae	Menstrual Inducer
Brosimum	Utile	Moraceae	Antiasthmatic
Brownea	Ariza	Leguminosae	Fertilization Inhibitor
Brownea	Ariza	Leguminosae	Destrogenic
Brunfelsia	Hopeana	Solanaceae	Antipyretic
Brunfelsia	Hopeana	Solanaceae	Antimalarial
Brunfelsia	Hopeana	Solanaceae	Antitoxic
Brunfelsia	Hopeana	Solanaceae	Antiinflammatory
Brunfelsia	Uniflora	Solanaceae	Abortifacient
Bursera	Graveolens	Burseraceae	CNS Stimulant
Bursera	Tomentosa	Burseraceae	Antitumor
Cajanus	Flavus	Leguminosae	Menstrual Inducer
Calea	Ocaniensis	Compositae	Antileprotic
Capsella	Bursa-Pastoris	Cruciferae	Menstrual Inducer
Caraipa	Laxiflora	Guttiferae	Antifungal
Caraipa	Parviellíptica	Guttiferae	Astringent
Caraipa	Parviellíptica	Guttiferae	Antipruritic
Casearia	Sylvestris	Flacourtiaceae	Antitumor
Cassia	Hirsuta	Leguminosae	Menstrual Inducer
Cassia	Hirsuta	Leguminosae	Uterine Relaxant
Chelonanthus	Alatus	Gentianaceae	Insecticide
Chlorophora	Tinctoria	Moraceae	Analgesic
Chlorophora	Tinctoria	Moraceae	Proteolytic
Chlorophora	Tinctoria	Moraceae	Tooth Extraction
Cinchona	Species	Rubiaceae	Fertilization Inhibitor
Cinnamomum	Camphora	Lauraceae	Anaphrodisiac

Genus	*Species*	*Family*	*Use*
Cissampelos	Pareira	Menispermaceae	Menstrual Inducer
Clusia	Amazónica	Guttiferae	Diuretic
Clusia	Chiribiquetensis	Guttiferae	Antifungal
Clusia	Columnaris	Guttiferae	Anesthetic (local)
Clusia	Gaudichaudii	Guttiferae	Anesthetic (local)
Clusia	Insignis	Guttiferae	Anesthetic (local)
Clusia	Microstemon	Guttiferae	Rubefacient
Clusia	Microstemon	Guttiferae	Anesthetic (local)
Clusia	Penduliflora	Guttiferae	Antifungal
Clusia	Planchoniana	Guttiferae	Anesthetic (local)
Clusia	Poaca	Guttiferae	Rubefacient
Clusia	Renggerioides	Guttiferae	Antidiarrheal
Clusia	Schultesii	Guttiferae	Wound Healig Accelerator
Clusia	Spathulaefolia	Guttiferae	Vermifuge
Connarus	Opacus	Connaraceae	Fish Poison
Connarus	Sprucei	Connaraceae	Fish Poison
Costus	Erythrocoryne	Zingiberaceae	Hemostatic
Coussapoa	Cinnamomea	Moraceae	Fish Poison
Cynodon	Dactylon	Gramineae	Uterine Relaxant
Cyphomandra	Crassifolia	Solanaceae	Vermifuge
Cyphomandra	Dolichorachis	Solanaceae	Vermifuge
Datura	Species	Solanaceae	Uterine Relaxant
Desfontainia	Spinosa	Desfontainiaceae	Hallucinogenic
Dieffenbachia	Picta	Araceae	Contraceptive/Interceptive
Distictella	Racemosa	Bignoniaceae	Arrow Poison
Draba	Litamo	Cruciferae	Antitumor
Duranta	Mutisii	Verbenaceae	Antiinflammatory
Duroia	Hirsuta	Rubiaceae	Caustic
Duroia	Hirsuta	Rubiaceae	Anticariogenic
Duroia	Kotchubaeoides	Rubiaceae	Toxic Effect
Duroia	Petiolaris	Rubiaceae	Toxic Effect
Duroia	Saccifera	Rubiaceae	Toxic Effect
Duroia	Species	Rubiaceae	Toxic Effect
Duroia	Sprucei	Rubiaceae	Toxic Effect
Erythroxylum	Coca	Erythroxylaceae	CNS Stimulant
Erythroxylum	Coca	Erythroxylaceae	Euphoriant
Erythroxylum	Coca	Erythroxylaceae	Andrexic
Erythroxylum	Coca	Erythroxylaceae	Antifatigue
Erythroxylum	Novogranatense	Erythroxylaceae	CNS Stimulant

Genus	*Species*	*Family*	*Activity*
Erythroxylum	Novogranatense	Erythroxylaceae	Euphoriant
Erythroxylum	Novogranatense	Erythroxylaceae	Anorexic
Erythroxylum	Novogranatense	Erythroxylaceae	Antifatigue
Eupatorium	Acuminatum	Compositae	Menstrual Inducer
Eupatorium	Angustifolium	Compositae	Menstrual Inducer
Eupatorium	Odoratum	Compositae	Antitumor
Eupatorium	Tinifolium	Compositae	Antitumor
Euphorbia	Hypericifolia	Euphorbiaceae	Antitumor
Euphorbia	Parvifolia	Euphorbiaceae	Antitumor
Foeniculum	Vulgare	Umbelliferae	Galactagogue
Franseria	Artemisioides	Compositae	Contraceptive/Interceptive
Gliricidia	Sepium	Leguminosae	Menstrual Inducer
Gnaphalium	Elegans	Compositae	Antitumor
Gnaphalium	Elegans	Compositae	Antiinflammatory
Gnaphalium	Pellitum	Compositae	Sweetening Effect
Gossypium	Hirsutum	Malvaceae	Menstrual Inducer
Guatteria	Dura	Annonaceae	Arrow Poison
Guazuma	Ulmifolia	Sterculiaceae	Fertilization Inhibitor
Hancornia	Speciosa	Apocynaceae	Escharotic
Havetiopsis	Flexilis	Guttiferae	Wound Healing Accelerator
Hedychium	Coronarium	Zingiberaceae	Analgesic
Helicteres	Baruensis	Sterculiaceae	Contraceptive/Interceptive
Himatanthus	Bracteatus	Apocynaceae	Antivenin
Himatanthus	Phagedaenicus	Apocynaceae	Antivenin
Himatanthus	Phagedaenicus	Apocynaceae	Toxic Effect
Himatanthus	Sucuuba	Apocynaceae	Toxic Effect
Humiria	Balsamifera	Humiriaceae	Wound Healing Accelerator
Humiria	Crassifolia	Humiriaceae	Wound Healing Accelerator
Humiriastrum	Piraparanense	Humiriaceae	Emetic
Humiriastrum	Piraparanense	Humiriaceae	Laxative
Humiriastrum	Villosum	Humiriaceae	Laxative
Iochroma	Fuchsioides	Solanaceae	Hallucinogenic
Jaltomata	Procumbens	Solanaceae	Antipyretic
Jaltomata	Procumbens	Solanaceae	Diuretic
Jessenia	Bataua	Palmae	Antitussive
Jessenia	Bataua	Palmae	Antiasthmatic
Jessenia	Bataua	Palmae	Antituberculosis
Jessenia	Bataua	Palmae	Hair Conditioner
Ladenbergia	Species	Rubiaceae	Fertilization Inhibitor
Lantana	Cámara	Verbenaceae	Fertilization Inhibitor

Genus	*Species*	*Family*	*Use*
Lantana	Cámara	Verbenaceae	Menstrual Inducer
Lantana	Trifolia	Verbenaceae	Female Disorders
Libidibia	Coriaria	Leguminosae	Antitumor
Lippia	Americana	Verbenaceae	Menstrual Inducer
Lippia	Origanoides	Verbenaceae	Menstrual Inducer
Luffa	Acutángula	Cucurbitaceae	Menstrual Inducer
Lunania	Parviflora	Flacourtiaceae	Toxic Effect
Lycopodium	Species	Lycopodiaceae	Menstrual Inducer
Malouetia	Tamaquarina	Apocynaceae	Hallucinogenic
Malouetia	Tamaquarina	Apocynaceae	Toxic Effect
Malouetia	Tamaquarina	Apocynaceae	Wound Healing Accelerator
Mandevilla	Anceps	Apocynaceae	Escharotic
Mandevilla	Annulariifolia	Apocynaceae	Escharotic
Mandevilla	Cuneifolia	Apocynaceae	Toxic Effect
Mandevilla	Nerioides	Apocynaceae	Antifungal
Mandevilla	Scabra	Apocynaceae	Hair Growth Inhibition
Mandevilla	Stephanotidifolia	Apocynaceae	Antibacterial
Mandevilla	Stephanotidifolia	Apocynaceae	Antivenin
Mandevilla	Steyermarkii	Apocynaceae	Hemostatic
Mandevilla	Steyermarkii	Apocynaceae	Antibacterial
Mandevilla	Steyermarkii	Apocynaceae	Aphrodisiac
Mandevilla	Steyermarkii	Apocynaceae	Antidiarrheal
Mandevilla	Subcarnosa	Apocynaceae	Toxic Effect
Mandevilla	Thevetioides	Apocynaceae	Arrow Poison
Mandevilla	Trianae	Apocynaceae	Antibacterial
Mandevilla	Vanheurckii	Apocynaceae	Antifungal
Manihot	Esculenta	Euphorsiaceae	Vermifuge
Marila	Tomentosa	Guttiferae	Antidiarrheal
Marsdenia	Cundurango	Asclepiadaceae	Antitumor
Martinella	Obovata	Bignoniaceae	Arrow Poison
Martynia	Annua	Martyniaceae	Menstrual Inducer
Martynia	Annua	Martyniaceae	Female Disorders
Martynia	Annua	Martyniaceae	Uterine Relaxant
Matricaria	Chamomilla	Compositae	Menstrual Inducer
Maytenus	Laevis	Celastraceae	Antiinflammatory
Maytenus	Laevis	Celastraceae	Aphrodisiac
Medicago	Sativa	Leguminosae	Galactagogue
Melilotus	Alba	Leguminosae	Antitumor
Mesechites	Trifida	Apocynaceas	Tranquilizing Effect
Mimosa	Púdica	Leguminosae	Fertilization Inhibitor

Genus	*Species*	*Family*	*Activity*
Montanoa	Quadrangularis	Compositae	Fertilization Inhibitor
Neea	Parviflora	Nyctaginaceae	Anticarogenic
Neurolaena	Lobata	Compositae	Antitumor
Ocotea	Caparrapí	Lauraceae	Antitumor
Odontadenia	Funigera	Apocynaceae	Gustatory Effect
Odontadenia	Neglecta	Apocynaceae	Analgesic
Odontadenia	Neglecta	Apocynaceae	Toxic Effect
Odontadenia	Sylvestris	Apocynaceae	Analgesic
Odontadenia	Sylvestris	Apocynaceae	Hemostatic
Odontadenia	Sylvestris	Apocynaceae	Insect Repellant
Oedematopus	Duidae	Guttiferae	Vermifuge
Oedematopus	Obovatus	Guttiferae	Vermifuge
Oedematopus	Octandrus	Guttiferae	Antifertility
Origanum	Majorana	Labiatae	Menstrual Inducer
Oxalis	Scandens	Oxalidaceae	Menstrual Inducer
Parahancornia	Amapa	Apocynaceae	Lung Problems
Parahancornia	Krukovii	Apocynaceae	Wound Healing Accelerator
Pedilanthus	Tithymaloides	Euphorbiaceae	Fertility Promotion
Peperomia	Glabella	Piperaceae	Antifibrinolytic
Peperomia	Macrostachya	Piperaceae	Antipyretic
Peperomia	Macrostachya	Piperaceae	Diuretic
Pereskia	Grandifolia	Cactaceae	Aphrodisiac
Pereskia	Grandifolia	Cactaceae	Uterine Relaxant
Persea	Americana	Lauraceae	Aphrodisiac
Persea	Americana	Lauraceae	Antifertility
Persea	Americana	Lauraceae	Abortifacient
Persea	Americana	Lauraceae	Menstrual Inducer
Petiveria	Alliacea	Phytolaccaceae	Anticariogenic
Petiveria	Alliacea	Phytolaccaceae	Fertilization Inhibitor
Philodendron	Dyscarpium	Araceae	Contraceptive/Interceptive
Phytolacca	Australis	Phytolaccaceae	Antiinflammatory
Phytolacca	Bogotensis	Phytolaccaceae	Antitumor
Phytolacca	Icosandra	Phytolaccaceae	Antitumor
Phytolacca	Rivinoides	Phytolaccaceae	Antitumor
Phytolacca	Rugosa	Phytolaccaceae	Antitumor
Phytolacca	Sanguínea	Phytolaccaceae	Antitumor
Pimpinella	Anisum	Umbelliferae	Galactagogue
Piper	Allenii	Piperaceae	Analgesic
Piper	Erythroxyloides	Piperaceae	CNS Stimulant
Piper	Erythroxyloides	Piperaceae	Antibacterial

Genus	*Species*	*Family*	*Use*
Piper	Marginatum	Piperaceae	Anticariogenic
Piper	Schultesii	Piperaceae	Antituberculosis
Piper	Schultesii	Piperaceae	Diuretic
Polymnia	Pyramidalis	Compositae	Menstrual Inducer
Pontederia	Cordata	Pontederiaceae	Narcotic
Potomorphe	Umbellata	Piperaceae	Arrow Poison
Protium	Heptaphyllum	Burseraceae	CNS Stimulant
Protium	Heptaphyllum	Burseraceae	Antitumor
Psychotria	Carthaginensis	Rubiaceae	Toxic Effect
Psychotria	Involucrata	Rubiaceae	Toxic Effect
Psychotria	Nudiceps	Rubiaceae	Toxic Effect
Psychotria	Psychotriaefolia	Rubiaceae	Hallucinogenic
Psychotria	Tomentosa	Rubiaceae	Menstrual Inducer
Pterocarpus	Rohrii	Leguminosae	Antipyretic
Qualea	Acuminata	Vochysiaceae	Taenifuge
Quapoya	Peruviana	Guttiferae	Fish Poison
Remijia	Species	Rubiaceae	Fertilization Inhibitor
Retiniphyllum	Schomburgkii	Rubiaceae	Vermifuge
Retiniphyllum	Speciosum	Rubiaceae	Vermifuge
Rheum	Palmatum	Polygonaceae	Fertility Promotion
Rhizophora	Brevistyla	Rhizophoraceae	Antitumor
Ricinus	Communis	Euphorbiaceae	Fertilization Inhibitor
Rosmarinus	Officinalis	Labiatae	Menstrual Inducer
Rourea	Glabra	Connaraceae	Fish Poison
Rumex	Obtusifolius	Polygonaceae	Laxative
Ruta	Chalepensis	Rutaceae	Abortifacient
Ruta	Chalepensis	Rutaceae	Menstrual Inducer
Ruta	Graveolens	Rutaceae	Fertilization Inhibitor
Ruta	Graveolens	Rutaceae	Menstrual Inducer
Schoenobiblus	Peruvianus	Thymelaeaceae	Fish Poison
Schoenobiblus	Peruvianus	Thymelaeaceae	Arrow Poison
Schradera	Marginalis	Rubiaceae	Anticariogenic
Senecio	Nitidus	Compositae	Female Disorders
Siphocampylus	Giganteus	Campanulaceae	Anticariogenic
Solanum	Vestissimum	Solanaceae	Antihypertensive
Souroubea	Guianensis	Marcgraviaceae	Tranquilizing Effect
Spondias	Mombin	Anacardiaceae	Contraceptive/Interceptive
Spondias	Mombin	Anacardiaceae	Destrogenic
Spondias	Mombin	Anacardiaceae	Progestagenic
Stachytarpheta	Cayennensis	Verbenaceae	Menstrual Inducer

Genus	*Species*	*Family*	*Use*
Stachytarpheta	Mutabilis	Verbenaceae	Menstrual Inducer
Stachytarpheta	Orubica	Verbenaceae	Menstrual Inducer
Stachytarpheta	Sprucei	Verbenaceae	Menstrual Inducer
Stachytarpheta	Straminea	Verbenaceae	Menstrual Inducer
Stevia	Bogotensis	Compositae	Antipyretic
Stevia	Bogotensis	Compositae	Diaphoretic
Stevia	Lucida	Compositae	Analgesic
Stevia	Lucida	Compositae	Antiinflammatory
Styrax	Tessmannii	Styracaceae	Toxic Effect
Swartzia	Auriculata	Leguminosae	Fish Poison
Swartzia	Cabrerae	Leguminosae	Vermifuge
Swartzia	Conferta	Leguminosae	Antidiarrheal
Swartzia	Microcarpa	Leguminosae	Antidiarrheal
Swartzia	Péndula	Leguminosae	Fish Poison
Swartzia	Racemosa	Leguminosae	Emetic
Swartzia	Racemosa	Leguminosae	Escharotic
Swartzia	Schomburgkii	Leguminosae	Vermifuge
Swartzia	Schultesii	Leguminosae	Fish Poison
Swartzia	Sericea	Leguminosae	Fish Poison
Synedrella	Nodiflora	Compositae	Menstrual Inducer
Tabernaemontana	Amygdalaefolia	Apocynaceae	Antitumor
Tabernaemontana	Grandifolia	Apocynaceae	Antiinflammatory
Tabernaemontana	Muricata	Apocynaceae	CNS Stimulant
Tabernaemontana	Rimulosa	Apocynaceae	CNS Depressant
Tabernaemontana	Sananho	Apocynaceae	Antipyretic
Tabernaemontana	Sananho	Apocynaceae	Emetic
Tabernaemontana	Sananho	Apocynaceae	CNS Depressant
Tabernaemontana	Sananho	Apocynaceae	Miscellanedus Effects
Tabernaemontana	Sananho	Apocynaceae	Diuretic
Tabernaemontana	Undulata	Apocynaceae	Vermifuge
Tachigalia	Cavipes	Leguminosae	Antipyretic
Tachigalia	Cavipes	Leguminosae	Emetic
Tachigalia	Cavipes	Leguminosae	Antifertility
Tagetes	Erecta	Compositae	Menstrual Inducer
Tagetes	Graveolens	Compositae	Abortifacient
Tagetes	Patula	Compositae	Abortifacient
Tagetes	Patula	Compositae	Menstrual Inducer
Tagetes	Pusilla	Compositae	Menstrual Inducer
Tagetes	Zipaquirensis	Compositae	Menstrual Inducer
Telitoxicum	Peruvianum	Menispermaceae	Arrow Poison

Genus	*Species*	*Family*	*Use*
Thymus	Vulgaris	Labiatae	Menstrual Inducer
Tithonia	Rotundifolia	Compositae	Menstrual Inducer
Tovomita	Laurina	Guttiferae	Antidiarrheal
Trichanthera	Gigantea	Acanthaceae	Menstrual Inducer
Trixis	Divaricata	Compositae	Menstrual Inducer
Trixis	Inula	Compositae	Menstrual Inducer
Turnera	Ulmifolia	Turneraceae	Aphrodisiac
Ullucus	Tuberosus	Basellaceae	Fertilization Inhibitor
Unonopsis	Veneficiorum	Annonaceae	Antifertility
Urospatha	Antisylléptica	Araceae	Contraceptive/Interceptive
Vanilla	Planifolia	Orchidaceae	Aphrodisiac
Vanilla	Planifolia	Orchidaceae	Menstrual Inducer
Verbena	Litoralis	Verbenaceae	Female Disorders
Veronia	Brachiata	Compositae	Female Disorders
Viburnum	Basiophyllum	Caprifoliaceae	Female Disorders
Viburnum	Basiophyllum	Caprifoliaceae	Uterine Relaxant
Viburnum	Cornifolium	Caprifoliaceae	Female Disorders
Viburnum	Cornifolium	Caprifoliaceae	Uterine Relaxant
Viburnum	Glabratum	Caprifoliaceae	Female Disorders
Viburnum	Glabratum	Caprifoliaceae	Uterine Relaxant
Viburnum	Pichinchense	Caprifoliaceae	Female Disorders
Viburnum	Pichinchense	Caprifoliaceae	Uterine Relaxant
Viburnum	Tinoides	Caprifoliaceae	Uterine Relaxant
Viburnum	Triphyllum	Caprifoliaceae	Female Disorders
Viburnum	Triphyllum	Caprifoliaceae	Uterine Relaxant
Viola	Humboldtii	Violaceae	Galactagogue
Virola	Albidiflora	Myristicaceae	Antifungal
Virola	Albidiflora	Myristicaceae	Wound Healing Accelerator
Vismia	Angusta	Guttiferae	Antibacterial
Vismia	Angusta	Guttiferae	Wound Healing Accelerator
Xylopia	Amazónica	Annonaceae	CNS Depressant
Xylopia	Aromática	Annonaceae	Diuretic
Xylopia	Aromática	Annonaceae	Uterine Relaxant
Xylopia	Benthamii	Annonaceae	Tranquilizing Effect
Zornia	Leptophylla	Leguminosae	Insect Repellant

TABLE II

Plants of Colombia with biological information

Genus	*Species*	*Family*	*Use*
Aetanthus	Colombianum	Loranthaceae	Toxicity (lethal dose)
Amyris	Pinnata	Rutaceae	Bacterial Stimulant
Amyris	Pinnata	Rutaceae	Antitumor
Amyris	Pinnata	Rutaceae	Cytotoxic
Brunfelsia	Chiricaspi	Solanaceae	Toxic Effect
Calotropis	Procera	Asclepiadaceae	Cardiotonic
Canavalia	Brasiliensis	Leguminosae	Hemagglutinin
Cinchona	Pubenscens	Rubiaceae	Cytotoxic
Dendropthora	Clavata	Loranthaceae	Toxicity (lethal dose)
Dendropthora	Subtrinervis	Loranthaceae	Toxic Effect
Ectopopterys	Soejartoi	Malpighiaceae	Antitumor
Ectopopterys	Soejartoi	Malpighiaceae	Cytotoxic
Ectopopterys	Soejartoi	Malpighiaceae	Uterine Stimulant
Erythrina	Edulis	Leguminosae	Hemagglutinin
Euphorbia	Tirucalli	Euphorbiaceae	Irritant
Jacaranda	Caucana	Bignoniaceae	Antitumor
Jacaranda	Caucana	Bignoniaceae	Cytotoxic
Malouetia	Nítida	Apocynaceae	Hypotensive
Maytenus	Laevis	Celastraceae	Analgesic
Maytenus	Laevis	Celastraceae	Antiinflammatory
Pennisetum	Purpureum	Gramineae	Toxicity (lethal dose)
Phoradendron	Obliquum	Loranthaceae	Toxicity (lethal dose)
Phoradendron	Piperoides	Loranthaceae	Female Disorders
Phytolacca	Australis	Phytolaccaceae	Hypotensive
Phytolacca	Australis	Phytolaccaceae	Toxicity
Phytolacca	Australis	Phytolaccaceae	Toxic Effect
Phytolacca	Australis	Phytolaccaceae	Toxicity (lethal dose)
Phytolacca	Australis	Phytolaccaceae	Smooth Muscle Stimulant
Polygonum	Punctatum	Polygonaceae	Fish Poison
Ryania	Dentata	Flacourtiaceae	Hypotensive
Ryania	Dentata	Flacourtiaceae	Toxicity
Stevia	Benthamiana	Compositae	Sweetening Effect
Stevia	Elatior	Compositae	Sweetening Effect
Stevia	Lúcida	Compositae	Sweetening Effect
Stevia	Nepetifolia	Compositae	Sweetening Effect
Stevia	Pallida	Compositae	Sweetening Effect
Stevia	Rhombifolia	Compositae	Sweetening Effect

Genus	*Species*	*Family*	*Use*
Stevia	Serrata	Compositae	Sweetening Effect
Thalictrum	Longistylum	Ranunculaceae	Hypotensive
Thalictrum	Longistylum	Ranunculaceae	Antibacterial
Thalictrum	Longistylum	Ranunculaceae	Antiyeast
Thalictrum	Longistylum	Ranunculaceae	Antituberculosis
Trifolium	Repens	Leguminosae	Antifertility
Trifolium	Repens	Leguminosae	Destrogenic
Xylosma	Velutinum	Flacourtiaceae	Cytotoxic